

# **Wearable multi-sensor systems using textile-based 2-D communication**

## **Project Leader**

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## **1. Objective**

### **This project is aimed at:**

Development of a body-scale sensing method using a wearable large-aperture sensor array. The sensor array consists of sensor elements attached to items of clothing made of conductive textiles. A conductive textile-based communication method, which enables both power supply and communication to arbitrary points on a conductive fabric, has been proposed by the project leader [1]-[3]. In this project, we will construct a wearable sensor network system embedded into an item of clothing. The sensor nodes are not wired individually, nor are they loaded with batteries or WiFi/Bluetooth modules. In sensor array systems, the spatial arrangement of sensor elements limits system performance. Even if the sensor elements themselves are miniaturized, there is an inevitable trade-off between downsizing the array and improving performance. Therefore, the means of carrying a large-area sensor array is a universal challenge. In this project, we propose a means of carrying an array by wearing it. We aim to develop a technology that will revolutionize a variety of human-related sensing applications, such as sensing the state of the human body itself and sensing the environment surrounding the human body.

## **2. Project Outline**

### **To that end, the project will consist of the following phases:**

- (a) mathematical analyses of the signal processing in flexible sensor arrays;
- (b) development of electronic circuits for the sensor nodes and for the data sink device; and
- (c) implementation of application software for demonstration of the wearable sensor array.

## **3. Expected Performance**

### **In this project, the successful candidate would be expected to:**

- (a) work independently;
- (b) think logically; and
- (c) enjoy tough challenges.

## **4. Required Skills and Knowledge**

### **The successful candidate for this project will have the following knowledge and skills:**

- (a) knowledge of the fundamentals of electronic circuits, and skill in soldering/handcrafting circuits under test;
- (b) knowledge of the fundamentals of signal processing; and
- (c) skill in programming with C-family languages and microcontrollers (e.g., Arduino).

## **References**

[1] NODA, Akihito; SHINODA, Hiroyuki. Inter-IC for Wearables (I2We): Power and data transfer over double-sided conductive textile. *IEEE Transactions on Biomedical Circuits and Systems*, 2018, 13.1: 80-90.

[2] NODA, Akihito. Demonstration of wireless access to batteryless and antennaless sensors distributed on

clothes. In: *2019 16th IEEE Annual Consumer Communications & Networking Conference (CCNC)*. IEEE, 2019. p. 1-2.

[3] NODA, Akihito. Wearable NFC reader and sensor tag for health monitoring. In: *2019 IEEE Biomedical Circuits and Systems Conference (BioCAS)*. IEEE, 2019. p. 1-4.

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